SELECTED REFERENCES, INTERNAL DOCUMENTS, AND PUBLICATIONS ON TECHNIQUES OF WATER-RESOURCES INVESTIGATIONS

SELECTED REFERENCES FOR GENERAL GUIDELINES — 6.0

- American Society for Testing and Materials, 1992, Standards on ground water and vadose zone investigations: American Society for Testing and Materials publication code number 03–418192–38, 166 p.
- Edwards, T.K., and Glysson, D.G., 1988, Field methods for measurement of fluvial sediment: U.S. Geological Survey Open-File Report 86–531, 118 p.
- Edwards, T.K., and Glysson, D.G., 1998, Field methods for measurement of fluvial sediment: Techniques of Water-Resources Investigations of the United States Geological Survey, book 3, chap. C2, 80 p.
- Fishman, M.J., and Friedman, L.C., 1989, Methods for determination of inorganic substances in water and fluvial sediments: Techniques of Water-Resources Investigations of the United States Geological Survey, book 5, chap. A1, 545 p.
- Horowitz, A.J., Demas, C.R., Fitzgerald, K.K., Miller, T.L., and Rickert, D.A., 1994, U.S. Geological Survey protocol for the collection and processing of surfacewater samples for the subsequent determination of inorganic constituents in filtered water: U.S. Geological Survey Open-File Report 94–539, 57 p.
- Hydrologic Instrumentation Facility, 1991, Hydrolab H2O, *in* Instrument News: Stennis Space Center, Miss., U.S. Geological Survey Hydrologic Instrumentation Facility, December 1991, p. 7–9.
- Hydrologic Instrumentation Facility, 1992, pH, *in* Instrument News: Stennis Space Center, Miss., U.S. Geological Survey Hydrologic Instrumentation Facility, March 1992, p. 7–8.
- Hydrologic Instrumentation Facility, 1992, pH, *in* Instrument News: Stennis Space Center, Miss., U.S. Geological Survey Hydrologic Instrumentation Facility, September 1992, p. 8.
- Hydrologic Instrumentation Facility, 1992, Conductivity, *in* Instrument News: Stennis Space Center, Miss., U.S. Geological Survey Hydrologic Instrumentation Facility, December 1992, p. 12–13.
- Hydrologic Instrumentation Facility, 1993, pH, *in* Instrument News: Stennis Space Center, Miss., U.S. Geological Survey Hydrologic Instrumentation Facility, March 1993, p. 10–14.
- Hydrologic Instrumentation Facility, 1992, Hydrolab's H2O, *in* Instrument News: Stennis Space Center, Miss., U.S. Geological Survey Hydrologic Instrumentation Facility, March 1993, p. 4–5.
- Hydrologic Instrumentation Facility, 1993, Dissolved oxygen, *in* Instrument News: Stennis Space Center, Miss., U.S. Geological Survey Hydrologic Instrumentation Facility, September 1993, unnumbered insert.
- Hydrologic Instrumentation Facility, 1994, Temperature measurement tests, *in* Instrument News: Stennis Space Center, Miss., U.S. Geological Survey Hydrologic Instrumentation Facility, September 1994, p. 3–7; 10–12.
- Hydrologic Instrumentation Facility, 1994, Turbidity meter tests, *in* Instrument News: Stennis Space Center, Miss., U.S. Geological Survey Hydrologic Instrumentation Facility, June 1994, p. 11–13.

- Kearl, P.M., Korte, N.E., and Cronk, T.A., 1992, Suggested modifications to ground water sampling procedures based on observations from the colloidal borescope: Ground Water Monitoring Review, v. 12, no. 2, p. 155–160.
- Koterba, M.T., Wilde, F.D., and Lapham, W.W., 1995, Ground-water data-collection protocols and procedures for the National Water-Quality Assessment Program—collection and documentation of water-quality samples and related data: U.S. Geological Survey Open-File Report 95–399, 113 p.
- Lapham, W.W., Wilde, F.D., and Koterba, M.T., 1997, Guidelines and standard procedures for studies of ground-water quality—selection and installation of wells, and supporting documentation: U.S. Geological Survey Water-Resources Investigations Report 96–4233, 110 p.
- Maddy, D.V., Lopp, L.E., Jackson, D.L., Coupe, R.H., and Schertz, T.L., 1989, National water information system user's manual—water-quality system: U.S. Geological Survey Open-File Report 89–617, v. 2, chap. 2, 222 p.
- Puls, R.W., and Powell, R.M., 1992, Acquisition of representative ground water quality samples for metals: Ground Water Monitoring Review, v. 12, no. 3, p. 167–176.
- Puls, R.W., Powell, R.M., Clark, D.A., and Paul, C.J., 1991, Facilitated transport of inorganic contaminants in ground water, part II, Colloidal transport: Ada, Oklahoma, Robert S. Kerr Laboratory, U.S. Environmental Protection Agency Report EPA/600/m-91/040, 12 p.
- Rantz, S.E., and others, 1982, Measurement and computation of streamflow: Volume 1, Measurement of stage, and Volume 2, Computation of discharge: U.S. Geological Survey Water-Supply Paper 2175, v. 1, p. 1–284, v. 2, p. 285–631.
- Stanley, D.L., Shampine, W.J., and Schroder, L.J., 1992, Summary of U.S. Geological Survey national field quality assurance program from 1979 through 1989: U.S. Geological Survey Open-File Report 92–163, 14 p.
- U.S. Geological Survey, 1978, Sediment, chap. 3 $\it in$ U.S. Geological Survey, National handbook of recommended methods for water-data acquisition: p. 3–1 to 3–100.
- Ward, J.R., and Harr, C.A., 1990, Methods for collection and processing of surface-water and bed-material samples for physical and chemical analyses: U.S. Geological Survey Open-File Report 90–140, 71 p.
- Wells, F.C., Gibbons, W.J., and Dorsey, M.E., 1990, Guidelines for collection and field analysis of water-quality samples from streams in Texas: U.S. Geological Survey Open-File Report 90–127, 79 p.

SELECTED REFERENCES FOR 6.1—TEMPERATURE

- American Public Health Association, American Water Works Association, and Water Environment Federation, 1992, Standard methods for the examination of water and wastewater (18th ed.): Washington, D.C., American Public Health Association, p. 2–59.
- Stevens, H.H. Jr., Ficke, J.F., and Smoot, G.F., 1975, Water temperature—influential factors, field measurement, and data presentation: U.S. Geological Survey Techniques of Water-Resources Investigations, book 1, chap. D1, 65 p.
- Ween, Sidney, 1968, Care and use of liquid-in-glass laboratory thermometers: Transactions of Instrument Society of America, v. 7, no. 2, p. 93–100.
- Wood, W.W., 1976, Guidelines for collection and field analysis of ground-water samples for selected unstable constituents: U.S. Geological Survey Techniques of Water-Resources Investigations, book 1, chap. D2, 24 p.

SELECTED REFERENCES FOR DISSOLVED OXYGEN — 6.2

- American Public Health Association, American Water Works Association, and Water Environment Federation, 1992, Standard methods for the examination of water and wastewater (18th ed.): Washington, D.C., American Public Health Association, p. 4–98 to 4–105.
- American Society for Testing and Materials, 1981, Standard test methods for dissolved oxygen in water, No. D 888: Philadelphia, American Society for Testing and Materials, p. 529–543.
- Brown, Eugene, Skougstad, M.W., and Fishman, M.J., 1970, Methods for collection and analysis of water samples for dissolved minerals and gases: U.S. Geological Survey Techniques of Water-Resources Investigations, book 5, chap. A1, p. 126–129.
- Hem, J.D., 1985, Study and interpretation of the chemical characteristics of natural water (3d ed.): U.S. Geological Survey Water-Supply Paper 2254, p. 155–156.
- Skougstad, M.W., Fishman, M.J., Friedman, L.C., Erdmann, D.E., and Duncan, S.S., eds., 1979, Methods for determination of inorganic substances in water and fluvial sediments: U.S. Geological Survey Techniques of Water-Resources Investigations, book 5, chap. A1, 626 p.
- Walters, G.L., ed., 1989, Hach water analysis handbook: Loveland, Colo., Hach Company, p. 430–452.
- Weiss, R.F., 1970, The solubility of nitrogen, oxygen and argon in water and seawater: Deep Sea Research, v. 17, p. 721–735.
- Wells, F.C., Gibbons, W.J., and Dorsey, M.E., 1990, Guidelines for collection and field analysis of water-quality samples from streams in Texas: U.S. Geological Survey Open-File Report 90–127, p. 56–65.
- White, A.F., Peterson, M.L., and Solbau, R.D., 1990, Measurement and interpretation of low levels of dissolved oxygen in ground water: Ground Water, v. 28, no. 4, p. 584–590.
- Wood, W.W., 1981, Guidelines for collection and field analysis of ground-water samples for selected unstable constituents: U.S. Geological Survey Techniques of Water-Resources Investigations, book 1, chap. D2, p. 22–24.

SELECTED REFERENCES FOR SPECIFIC ELECTRICAL CONDUCTANCE — 6.3

- American Public Health Association, American Water Works Association, and Water Environment Federation, 1992, Standard methods for the examination of water and wastewater (18th ed.): Washington, D.C., American Public Health Association, p. 2–43 to 2–48.
- American Society for Testing and Materials, 1977, Standard test methods for electrical conductivity and resistivity of water, No. D 1125–77: Philadelphia, American Society for Testing and Materials, p. 138–146.
- Brown, Eugene, Skougstad, M.W., and Fishman, M.J., 1970, Methods for collection and analysis of water samples for dissolved minerals and gases: U.S. Geological Survey Techniques of Water-Resources Investigations, book 5, chap. A1, p. 148–150.

- Fishman, M.J., and Friedman, L.C., eds., 1989, Methods for determination of inorganic substances in water and fluvial sediments: U.S. Geological Survey Techniques of Water-Resources Investigations, book 5, chap. A1, p. 461–463.
- Hem, J.D., 1982, Conductance—a collective measure of dissolved ions, *in* Minear, R.A., and Keith, L.H., eds., Water analysis, v. 1, inorganic species, pt. 1: New York, Academic Press, p. 137–161.
- 1985, Study and interpretation of chemical characteristics of natural water (3d ed.): U.S. Geological Survey Water-Supply Paper 2254, p. 66–69.
- Rainwater, F.H., and Thatcher, L.L., 1960, Methods for collection and analysis of water samples: U.S. Geological Survey Water-Supply Paper 1454, p. 275–278.
- Roberson, C.E., Feth, J.H., Seaber, P.R., and Anderson, Peter, 1963, Differences between field and laboratory determinations of pH, alkalinity, and specific conductance of natural water: U.S. Geological Survey Professional Paper 475–C, p. C212–C215.
- Shelton, L.R., 1994, Field guide for collecting and processing stream-water samples for the National Water-Quality Assessment Program: U.S. Geological Survey Open-File Report 94–455, 42 p.
- Wells, F.C., Gibbons, W.J., and Dorsey, M.E., 1990, Guidelines for collection and field analysis of water-quality samples from streams in Texas: U.S. Geological Survey Open-File Report 90–127, p. 42–44.
- Wood, W.W., 1981, Guidelines for collection and field analysis of ground-water samples for selected unstable constituents: U.S. Geological Survey Techniques of Water-Resources Investigations, book 1, chap. D2, p. 11.

SELECTED REFERENCES FOR 6.4—pH

- American Public Health Association, American Water Works Association, and Water Environment Federation, 1992, Standard methods for the examination of water and wastewater (18th ed.): Washington, D.C., American Public Health Association, p. 4–65 to 4–69.
- Barnes, Ivan, 1964, Field measurement of alkalinity and pH: U.S. Geological Survey Water-Supply Paper 1535–H, 17 p.
- Bates, R.G., 1973, Determination of pH—theory and practice (2d ed.): New York, John Wiley, 479 p.
- Beckman Instruments, Inc., 1986, The Beckman handbook of applied electrochemistry: Fullerton, Calif., 86 p.
- Brown, Eugene, Skougstad, M.W., and Fishman, M.J., 1970, Methods for collection and analysis of water samples for dissolved minerals and gases: U.S. Geological Survey Techniques of Water-Resources Investigations, book 5, chap. A1, p. 129–130.
- Busenberg, Eurybiades, and Plummer, L.N., 1987, pH measurement of low-conductivity waters: U.S. Geological Survey Water-Resources Investigations Report 87-4060, 21 p.
- Drever, J.I., 1988, The geochemistry of natural waters (2d ed.): Englewood Cliffs, N.J., Prentice-Hall, p. 282-304.
- Fishman, M.J., and Friedman, L.C., eds., 1989, Methods for determination of inorganic substances in water and fluvial sediments: U.S. Geological Survey Techniques of Water-Resources Investigations, book 5, chap. A1, p. 363–364.
- Hem, J.D., 1985, Study and interpretation of the chemical characteristics of natural water (3d ed.): U.S. Geological Survey Water-Supply Paper 2254, p. 61–66.

- Orion Research Inc., 1982, Handbook of electrode technology: Cambridge, Mass., p. P2–P4.
- Roberson, C.E., Feth, J.H., Seaber, P.R., and Anderson, Peter, 1963, Differences between field and laboratory determinations of pH, alkalinity, and specific conductance of natural water: U.S. Geological Survey Professional Paper 475–C, p. C212–C215.
- Shelton, L.R., 1994, Field guide for collecting and processing stream-water samples for the National Water-Quality Assessment Program: U.S. Geological Survey Open-File Report 94–455, 42 p.
- Stumm, Werner, and Morgan, J.J., 1981, Aquatic chemistry—an introduction emphasizing chemical equilibria in natural waters (2d ed.): New York, John Wiley & Sons, p. 131–134 and 483–487.
- Wells, F.C., Gibbons, W.J., and Dorsey, M.E., 1990, Guidelines for collection and field analysis of water-quality samples from streams in Texas: U.S. Geological Survey Open-File Report 90–127, p. 47–50.
- Wood, W.W., 1981, Guidelines for collection and field analysis of ground-water samples for selected unstable constituents: U.S. Geological Survey Techniques of Water-Resources Investigations, book 1, chap. D2, p. 12.

SELECTED REFERENCES FOR REDUCTION-OXIDATION POTENTIAL (ELECTRODE METHOD) — 6.5

- Adams, R.N., 1969, Electrochemistry at solid electrodes: New York, Marcel Dekker, $402~\rm p.$
- American Public Health Association, American Water Works Association, and Water Environment Federation, 1992, Standard methods for the examination of water and wastewater (18th ed.): Washington, D.C., American Public Health Association, p. 2–60 to 2–63.
- American Society for Testing and Materials, 1990, ASTM Standard Practice D 1498–76, Philadelphia, American Society for Testing and Materials, p. 208–212.
- Back, William, and Barnes, I.L., 1965, Relation of electrochemical potentials and iron content to ground-water flow patterns: U.S. Geological Survey Professional Paper 498–C, 16 p.
- Barcelona, M.J., Holm, T.R., Schock, M.R., and George, G.K., 1989, Spatial and temporal gradients in aquifer oxidation-reduction conditions: Water Resources Research, v. 25, no. 5, p. 991–1,003.
- Baedecker, M.J., and Cozzarelli, I.M., 1992, The determination and fate of unstable constituents of contaminated groundwater, *in* Lesage, Suzanne, and Jackson, R.E., eds., Groundwater contamination and analysis at hazardous waste sites: New York, Marcel Dekker, p. 425–461.
- Bates, R.G., 1973, Determination of pH, theory and practice (2d ed.): New York, John Wiley & Sons, p. 333–336.
- Berner, R.A., 1963, Electrode studies of hydrogen sulfide in marine sediments: Geochimica et Cosmochimica Acta, v. 27, p. 563–575.
- _____ 1981, A new geochemical classification of sedimentary environments: Journal of Sedimentary Petrology, v. 51, 359–365.

- Boulegue, Jacques, and Michard, Gil, 1979, Sulfur speciations and redox processes in reducing environments, *in* Jenne, E.A., ed., Chemical modeling in aqueous systems: Washington, D.C., American Chemical Society Symposium Series 93, p. 25–50.
- Bricker, O.P., 1965, Some stability relations in the system Mn-O₂-H₂O at 25°C and 1 atm, total pressure: American Mineralogist, v. 50, p. 1,296–1,354.
- _____1982, Redox potential—its measurement and importance in water systems, *in* Minear, R.A., and Keith, L.H., eds., Water analysis, v. 1, pt. 1: Orlando, Fla., Academic Press, p. 55–83.
- Callame, B., 1968, Contribution a l'etude des potentials d'oxydo-reduction dans les sediments marins: Cah. Oceanographie, v. 20, p. 305–319.
- Champ, D.R., Gulens, R.L., and Jackson, R.E., 1979, Oxidation-reduction sequences in ground water flow systems: Canadian Journal of Earth Science, v. 16, p. 12–23.
- Chateau, H., 1954, Déterminations précises des potentiels de référence données par les electrodes au calomel entre 5 et 70°C: Journal de Chimie Physique, v. 51, p. 590–593.
- Doyle, R.W., 1968, The origin of the ferrous-ion ferric oxide Nernst potential in environments containing dissolved ferrous iron: American Journal of Science, v. 266, p. 840–859.
- Edmunds, W.M., 1973, Trace element variations across an oxidation-reduction barrier in a limestone aquifer: Proceedings of Symposium on Hydrogeochemistry and Biogeochemistry, Tokyo, 1970, p. 500–527.
- Ficken, J.R., 1988, Recent development of downhole water samplers for trace organics, *in* Collins, A.G., and Johnson, A.I., eds., 1988, Ground-water contamination—field methods: American Society for Testing and Materials Special Technical Publication 963, Philadelphia, ASTM, p. 253–257.
- Hem, J.D., 1982, Conductance—a collective measure of dissolved ions, *in* Minear, R.A., and Keith, L.H., eds., Water analysis, v. 1, inorganic species, pt. 1: New York, Academic Press, p. 137–161.
- Hostettler, J.D., 1984, Electrode electrons, aqueous electrons, and redox potentials in natural waters: American Journal of Science, v. 284, p. 734–759.
- Langmuir, Donald, 1971, Eh-pH determination, *in* Carver, R.E., ed., Sedimentary petrology: New York, John Wiley & Sons, p. 597–634.
- Lindberg, R.D., and Runnells, D.D., 1984, Ground water redox reactions—an analysis of equilibrium state applied to Eh measurements and geochemical modeling: Science, v. 225, p. 925–927.
- Nordstrom, D.K., 1977, Thermochemical redox equilibria of ZoBell's solution: Geochimica et Cosmochimica Acta, v. 41, p. 1,835–1,841.
- Nordstrom, D.K., Jenne, E.A., and Ball, J.W., 1979, Redox equilibria of iron in acid mine waters, *in* Jenne, E.A., ed., Chemical modeling in aqueous systems: Washington, D.C., American Chemical Society Symposium Series 93, p. 51–79.
- Pankow, J.F., 1991, Aquatic chemistry concepts: Chelsea, Mich., Lewis Publishers, 673 p.
- Sato, Michiaki, 1960, Dissolved oxygen in aqueous systems: Economic Geology, v. 55, p. 928–949.
- Stumm, Werner, 1966, Redox potential as an environmental parameter—conceptual significance and operational limitation, *in* Advances in water pollution research—Proceedings of the Third International Conference, Munich, Germany, September 1966: p. 283–307.

- Stumm, Werner, and Morgan, J.J., 1981, Aquatic chemistry—an introduction emphasizing chemical equilibria in natural waters (2d ed.): New York, John Wiley & Sons, 780 p.
- Thorstenson, D.C., 1984, The concept of electron activity and its relation to redox potentials in aqueous geochemical systems: U.S. Geological Survey Open-File Report 84-072, 45 p.
- Thorstenson, D.C., Fisher, D.W., and Croft, M.G., 1979, The geochemistry of the Fox Hills-Basal Hell Creek aquifer in southwestern North Dakota and northwestern South Dakota: Water Resources Research, v. 15, p. 1,479-1,498.
- Truesdell, A.H., 1968, The advantage of using perather than Eh in redox equilibrium calculations: Journal of Geological Education, v. 16, p. 17–20.
- U.S. Geological Survey, 1977, Ground water, chap. 2, in U.S. Geological Survey, National handbook of recommended methods for water-data acquisition: p. 2-101 to 2-108.
- Welch, A.H., Lico, M.S., and Hughes, J.L., 1988, Arsenic in ground water of the western United States: Ground Water, v. 26, no. 3, p. 333–347.
- Whitfield, M.S., 1974, Thermodynamic limitations on the use of the platinum electrode in Eh measurements: Limnology and Oceanography, v. 19, p. 857-865.

SELECTED REFERENCES FOR ALKALINITY AND ACID NEUTRALIZING CAPACITY—6.6

- Almgren, Tom, Dryssen, David, and Strandberg, Mats, 1977, Computerized highprecision titrations of some major constituents of seawater on board the R.V. Dmitry Mendeleev: Deep-Sea Research, v. 24, p. 345-364.
- American Public Health Association, American Water Works Association, and Water Environment Federation, 1992, Standard methods for the examination of water and wastewater (18th ed.): Washington, D.C., American Public Health Association, p. 2-25 to 2-28.
- American Society for Testing and Materials, 1977, Standard test methods for acidity or alkalinity of water, No. D 1067: Philadelphia, American Society for Testing and Materials, p. 129-137.
- Baedecker, M.J., and Cozzarelli, I.M., 1992, The determination and fate of unstable constituents of contaminated groundwater, in Lesage, Suzanne, and Jackson, R.E., eds., Groundwater contamination and analysis at hazardous waste sites: New York, Marcel Dekker, p. 425-461.
- Barnes, Ivan, 1964, Field measurement of alkalinity and pH: U.S. Geological Survey Water-Supply Paper 1535-H, 17 p.
- Brown, Eugene, Skougstad, M.W., and Fishman, M.J., 1970, Methods for collection and analysis of water samples for dissolved minerals and gases: U.S. Geological Survey Techniques of Water-Resources Investigations, book 5, chap. A1, p. 41-44.
- Drever, J.I., 1988, The geochemistry of natural waters (2d ed.): Englewood Cliffs, N.J., Prentice-Hall, p. 48-58.
- Edmond, J.M., 1970, High precision determination of titration alkalinity and total carbon dioxide content of sea water by potentiometric titration: Deep Sea Research, v. 17, p. 737-750.

- Fishman, M.J., and Friedman, L.C., eds., 1989, Methods for determination of inorganic substances in water and fluvial sediments: U.S. Geological Survey Techniques of Water Resources Investigations, book 5, chap. A1, 545 p.
- Hansson, Ingemar, and Jagner, Daniel, 1973, Evaluation of the accuracy of Gran plots by means of computer calculations—application to the potentiometric titration of the total alkalinity and carbonate content in sea water: Amsterdam, Elsevier Scientific Publishing Co., 12 p.
- Hem, J.D., 1985, Study and interpretation of the chemical characteristics of natural water (3d ed.): U.S. Geological Survey Water-Supply Paper 2254, p. 105–111.
- Horowitz, A.J., Demas, C.R., Fitzgerald, K.K., Miller, T.L., and Rickert, D.A., 1994, U.S. Geological Survey protocol for the collection and processing of surfacewater samples for the subsequent determination of inorganic constituents in filtered water: U.S. Geological Survey Open-File Report 94–539, 57 p.
- Roberson, C.E., Feth, J.H., Seaber, P.R., and Anderson, Peter, 1963, Differences between field and laboratory determinations of pH, alkalinity, and specific conductance of natural water: U.S. Geological Survey Professional Paper 475– C, p. C212–C215.
- Stumm, Werner, and Morgan, J.J., 1981, Aquatic chemistry—an introduction emphasizing chemical equilibria in natural waters (2d ed.): New York, John Wiley & Sons, p. 171–229.
- Wells, F.C., Gibbons, W.J., and Dorsey, M.E., 1990, Guidelines for collection and field analysis of water-quality samples from streams in Texas: U.S. Geological Survey Open-File Report 90–127, 79 p.
- Wood, W.W., 1981, Guidelines for collection and field analysis of ground-water samples for selected unstable constituents: U.S. Geological Survey Techniques of Water-Resources Investigations, book 1, chap. D2, p. 15–18.
- Yurewicz, M.C., 1981, Incremental field titration of bicarbonate: U.S. Geological Survey Water Resources Division Bulletin, October-December 1981, p. 8–13.

SELECTED REFERENCES FOR 6.7—TURBIDITY

- American Public Health Association, American Water Works Association, and Water Environment Federation, 1992, Standard methods for the examination of water and wastewater (18th ed.): Washington, D.C., American Public Health Association, p. 2–8 to 2–11.
- American Society for Testing and Materials, 1990, Annual book of ASTM standards, v. 11.01, Part 31, "Water," Standard D1889–88a: Philadelphia, American Society for Testing and Materials, p. 309–314.
- Backhus, D.A., Ryan, J.N., Groher, D.M., MacFarlane, J.K., and Gschwend, P.M., 1993, Sampling colloids and colloid-associated contaminants in ground water: Ground Water, v. 31, no. 3, p. 466–479.
- Edwards, T.K., and Glysson, D.G., 1988, Field methods for measurement of fluvial sediment: U.S. Geological Survey Open-File Report 86–531, 118 p.
- Edwards, T.K., and Glysson, D.G., 1998, Field methods for measurement of fluvial sediment: Techniques of Water-Resources Investigations of the United States Geological Survey, book 3, chap. C2, 80 p.
- Gschwend, P.M., Backhus, D.A., MacFarlane, J.K., and Page, A.L., 1990, Mobilization of colloids in groundwater due to infiltration of water at a coal ash disposal site: Journal of Contaminant Hydrology, v. 6, p. 307–320.

- Hach, C.C., Vanous, R.D., and Heer, J.M., 1990, Understanding turbidity measurement, technical information series—Booklet No. 11, first ed: Loveland, Colorado, Hach Company, 11 p.
- Hydrologic Instrumentation Facility, 1994, Turbidity meter tests, *in* Instrument News: Stennis Space Center, Miss., U.S. Geological Survey, Hydrologic Instrumentation Facility, June 1994, p. 11–12.
- Kearl, P.M., Korte, N.E., and Cronk, T.A., 1992, Suggested modifications to ground water sampling procedures based on observations from the colloidal borescope: Ground Water Monitoring Review, v. 12, no. 2, p. 155–160.
- King, Karl, 1991, Four-beam turbidimeter for low NTU waters, *in* Water, October 1991, Journal of the Australian Water and Wastewater Association.
- McCluney, W.R., 1975, Radiometry of water turbidity measurements: Water Pollution Control Federation, v. 47, no. 2, p. 252–266.
- McCoy, W.F., and Olson, B.H., 1986, Relationship among turbidity, particle counts and bacteriological quality within water distribution lines: Water Research, v. 20, no. 8, p. 1023–1029.
- Nightingale, H.I., and Bianchi, W.C., 1977, Ground-water turbidity resulting from artificial recharge: Ground Water, v. 15, no. 2, p. 146–152.
- Pickering, R.J., 1976, Measurement of turbidity and related characteristics of natural waters: U.S. Geological Survey Open-File Report 76–153, 13 p.
- Puls, R.W., and Powell, R.M., 1992, Acquisition of representative ground water quality samples for metals: Ground Water Monitoring Review, v. 12, no. 3, p. 167–176.
- Shelton, L.R., 1994, Field guide for collecting and processing stream-water samples for the National Water-Quality Assessment Program: U.S. Geological Survey Open-File Report 94–455, 42 p.
- Shelton, L.R., and Capel, P.D., 1994, Guidelines for collecting and processing samples of stream bed sediment for analysis of trace elements and organic contaminants for the National Water-Quality Assessment Program: U.S. Geological Survey Open-File Report 94–458, 20 p.
- Strausberg, S.I., 1983, Turbidity interferes with accuracy in heavy metal concentrations: Industrial Wastes, v. 29, no. 2, p. 16–21.
- U.S. Environmental Protection Agency, 1979, Methods for chemical analysis of water and wastes: EPA/600/4/79/020, p. 180.1–1 to 180.1–3.
- U.S. Environmental Protection Agency, 1994, Technical notes on drinking water methods: EPA/600/R-94/173, October 1994, p. 28.
- U.S. Geological Survey, 1984, Chemical and physical quality of water and sediment, chap. 5, *in* U.S. Geological Survey, National handbook of recommended methods for water-data acquisition: p. 5–1 to 5–194.
- Ward, J.R., and Harr, C.A., 1990, Methods for collection and processing of surface-water and bed-material samples for physical and chemical analyses: U.S. Geological Survey Open-File Report 90–140, 71 p.
- Wells, M.C., Magaritz, Mordeckai, Ameil, A.J., Rophe, Benjamin, and Ronen, Daniel, 1989, Determination of in situ metal partitioning between particulate matter and ground water: Naturwissenchaften, v. 76, no. 12, p. 568– 570.

INTERNAL DOCUMENTS

The following training documents and memorandums are available in U.S. Geological Survey, Water Resources Division (WRD) offices nationwide. The technical memorandums listed are available electronically on the World Wide Web. The URL is: http://water.usgs.gov/public/admin/memo.

- Sylvester, M.A., Kister, L.R., and Garrett, W.B., eds., 1990, Guidelines for collection, treatment, and analyses of water samples—U.S. Geological Survey Western Region Field Manual: U.S. Geological Survey, Western Region, Internal Document, 144 p.
- U.S. Geological Survey, 1990, Water-Quality Field Techniques Training Manual: Quality of Water Service Unit, Ocala, Fla., Internal Document, 164 p.

Technical Memorandums

Water Quality

- 76.25-t. WATER QUALITY—Analytical methods: microbiological. September 1, 1976.
- 79.10. ANALYTICAL METHODS—Recommended procedures for calibrating dissolved oxygen meters. March 14, 1979.
- 81.11. WATER QUALITY—New tables of dissolved oxygen saturation values. May 8, 1981.
- 81.15. WATER QUALITY—New tables of dissolved oxygen saturation values: amendment of quality of water technical memorandum no. 81. May 27, 1981.
- 93.10. PROGRAMS AND PLANS—(1) Disposal of petri dishes containing bacteria media, and (2) Aspergillus. April 19, 1993.

WRD

91.09. PUBLICATIONS—Quality systems terminology. November 28, 1990.

PUBLICATIONS ON TECHNIQUES OF WATER-RESOURCES INVESTIGATIONS

The U.S. Geological Survey publishes a series of manuals describing procedures for planning and conducting specialized work in water-resources investigations. The material is grouped under major subject headings called books and is further divided into sections and chapters. For example, Section A of Book 9 (Handbooks for Water-Resources Investigations) pertains to collection of water-quality data. The chapter, which is the unit of publication, is limited to a narrow field of subject matter. This format permits flexibility in revision and publication as the need arises.

The reports listed below are for sale by the U.S. Geological Survey, Branch of Information Services, Box 25286, Federal Center, Denver, Colorado 80225 (authorized agent of the Superintendent of Documents, Government Printing Office). Prepayment is required. Remittance should be sent by check or money order payable to the U.S. Geological Survey. Prices are not included because they are subject to change. Current prices can be obtained by writing to the above address. When ordering or inquiring about prices for any of these publications, please give the title, book number, chapter number, and "U.S. Geological Survey Techniques of Water-Resources Investigations."

Book 1. Collection of Water Data by Direct Measurement Section D. Water Quality

- 1-D1.Water temperature—influential factors, field measurement, and data presentation, by H. H. Stevens, Jr., J. F. Ficke, and G. F. Smoot: USGS—TWRI Book 1, Chapter D1. 1975. 65 pages.
- 1–D2.Guidelines for collection and field analysis of ground-water samples for selected unstable constituents, by W. W. Wood: USGS—TWRI Book 1, Chapter D2. 1976. 24 pages. [Reprinted 1981]

Book 2. Collection of Environmental Data

Section D. Surface Geophysical Methods

- 2-D1.Application of surface geophysics to ground-water investigations, by A. A. R. Zohdy, G. P. Eaton, and D. R. Mabey: USGS—TWRI Book 2, Chapter D1. 1974. 116 pages.
- 2–D2.Application of seismic-refraction techniques to hydrologic studies, by F. P. Haeni: USGS—TWRI Book 2, Chapter D2. 1988. 86 pages.

Section E. Subsurface Geophysical Methods

- 2–E1.Application of borehole geophysics to water-resources investigations, by W. S. Keys and L.M. MacCary: USGS—TWRI Book 2, Chapter E1. 1971. 126 pages.
- 2–E2.Borehole geophysics applied to ground-water investigations, by W. S. Keys: USGS—TWRI Book 2, Chapter E2. 1990. 150 pages.

Section F. Drilling and Sampling Methods

2-F1.Application of drilling, coring, and sampling techniques to test holes and wells, by Eugene Shuter and W. E. Teasdale: USGS—TWRI Book 2, Chapter F1. 1989. 97 pages.

Book 3. Applications of Hydraulics

Section A. Surface-Water Techniques

- 3-A1.General field and office procedures for indirect discharge measurements, by M. A. Benson and Tate Dalrymple: USGS—TWRI Book 3, Chapter A1. 1967. 30 pages.
- 3-A2.Measurement of peak discharge by the slope-area method, by Tate Dalrymple and M. A. Benson: USGS—TWRI Book 3, Chapter A2. 1967. 12 pages.
- 3-A3.Measurement of peak discharge at culverts by indirect methods, by G. L. Bodhaine: USGS—TWRI Book 3, Chapter A3. 1968. 60 pages.
- 3-A4.Measurement of peak discharge at width contractions by indirect methods, by H. F. Matthai: USGS—TWRI Book 3, Chapter A4. 1967. 44 pages.
- 3-A5.Measurement of peak discharge at dams by indirect methods, by Harry Hulsing: USGS—TWR Book 3. Chapter A5. 1967. 29 pages.
- 3-A6.General procedure for gaging streams, by R. W. Carter and Jacob Davidian: USGS—TWRI Book 3, Chapter A6. 1968. 13 pages.
- 3-A7.Stage measurement at gaging stations, by T. J. Buchanan and W. P. Somers: USGS—TWRI Book 3, Chapter A7. 1968. 28 pages.
- 3-A8.Discharge measurements at gaging stations, by T. J. Buchanan and W. P. Somers: USGS—TWRI Book 3, Chapter A8. 1969. 65 pages.
- 3-A9.Measurement of time of travel in streams by dye tracing, by F. A. Kilpatrick and J. F. Wilson, Jr.: USGS—TWRI Book 3, Chapter A9. 1989. 27 pages.
- 3-Al0.Discharge ratings at gaging stations, by E. J. Kennedy: USGS—TWRI Book 3, Chapter A10. 1984. 59 pages.
- 3-A11.Measurement of discharge by the moving-boat method, by G. F. Smoot and C. E. Novak: USGS—TWRI Book 3, Chapter A11. 1969. 22 pages.
- 3-A12.Fluorometric procedures for dye tracing, Revised, by J. F. Wilson, Jr., E. D. Cobb, and F.A. Kilpatrick: USGS—TWRI Book 3, Chapter A12. 1986. 34 pages.
- 3-A13.Computation of continuous records of streamflow, by E. J. Kennedy: USGS—TWRI Book 3, Chapter A13. 1983. 53 pages.
- 3-A14.Use of flumes in measuring discharge, by F. A. Kilpatrick and V. R. Schneider: USGS—TWRI Book 3, Chapter A14. 1983. 46 pages.
- 3-A15.Computation of water-surface profiles in open channels, by Jacob Davidian: USGS—TWRI Book 3, Chapter A15. 1984. 48 pages.
- 3-A16.Measurement of discharge using tracers, by F. A. Kilpatrick and E. D. Cobb: USGS—TWRI Book 3, Chapter A16. 1985. 52 pages.
- 3-A17.Acoustic velocity meter systems, by Antonius Laenen: USGS—TWRI Book 3, Chapter A17. 1985. 38 pages.
- 3-A18.Determination of stream reaeration coefficients by use of tracers, by F. A. Kilpatrick, R. E. Rathbun, Nobuhiro Yotsukura, G. W. Parker, and L. L. DeLong: USGS—TWRI Book 3, Chapter A18. 1989. 52 pages.
- 3-A19.Levels at streamflow gaging stations, by E.J. Kennedy: USGS—TWRI Book 3, Chapter A19. 1990. 31 pages.

- 3–A20.Simulation of soluble waste transport and buildup in surface waters using tracers, by F.A. Kilpatrick: USGS—TWRI Book 3, Chapter A20. 1993. 38 pages.
- 3-A21.Stream-gaging cableways, by C. Russell Wagner: USGS—TWRI Book 3, Chapter A21. 1995. 56 pages.

Section B. Ground-Water Techniques

- 3-B1. Aquifer-test design, observation, and data analysis, by R. W. Stallman: USGS—TWRI Book 3, Chapter B1. 1971. 26 pages.
- 3-B2.Introduction to ground-water hydraulics, a programed text for self-instruction, by G. D. Bennett: USGS— TWRI Book 3, Chapter B2. 1976. 172 pages.
- 3-B3. Type curves for selected problems of flow to wells in confined aquifers, by J. E. Reed: USGS—TWRI Book 3, Chapter B3. 1980. 106 pages.
- 3-B4.Regression modeling of ground-water flow, by R. L. Cooley and R. L. Naff: USGS—TWRI Book 3, Chapter B4. 1990. 232 pages.
- 3-B4.Supplement 1. Regression modeling of ground-water flow—Modifications to the computer code for nonlinear regression solution of steady-state ground-water flow problems, by R.L. Cooley: USGS—TWRI Book 3, Chapter B4. 1993. 8 pages.
- 3–B5.Definition of boundary and initial conditions in the analysis of saturated ground-water flow systems—An introduction, by O. L. Franke, T. E. Reilly, and G. D. Bennett: USGS—TWRI Book 3, Chapter B5. 1987. 15 pages.
- 3–B6. The principle of superposition and its application in ground-water hydraulics, by T. E. Reilly, O. L. Franke, and G. D. Bennett: USGS—TWRI Book 3, Chapter B6. 1987. 28 pages.
- 3-B7. Analytical solutions for one-, two-, and three-dimensional solute transport in ground-water systems with uniform flow, by E. J. Wexler: USGS—TWRI Book 3, Chapter B7. 1992. 190 pages.

Section C. Sedimentation and Erosion Techniques

- 3-C1.Fluvial sediment concepts, by H. P. Guy: USGS—TWRI Book 3, Chapter C1. 1970. 55 pages.
- 3-C2. Field methods for measurement of fluvial sediment, by T.K. Edwards and G.D. Glysson: USGS—TWRI Book 3, Chapter C2. 1998. 80 p.
- 3-C3.Computation of fluvial-sediment discharge, by George Porterfield: USGS—TWRI Book 3, Chapter C3. 1972. 66 pages.

Book 4. Hydrologic Analysis and Interpretation

Section A. Statistical Analysis

- 4-A1. Some statistical tools in hydrology, by H. C. Riggs: USGS—TWRI Book 4, Chapter A1. 1968. 39 pages.
- 4-A2.Frequency curves, by H.C. Riggs: USGS—TWRI Book 4, Chapter A2. 1968. 15 pages.

Section B. Surface Water

- 4–B1.Low-flow investigations, by H.C. Riggs: USGS—TWRI Book 4, Chapter B1. 1972. 18 pages.
- 4-B2.Storage analyses for water supply, by H.C. Riggs and C.H. Hardison: USGS—TWRI Book 4, Chapter B2. 1973. 20 pages.
- 4-B3.Regional analyses of streamflow characteristics, by H.C. Riggs: USGS—TWRI Book 4, Chapter B3. 1973. 15 pages.

Section D. Interrelated Phases of the Hydrologic Cycle

4-D1.Computation of rate and volume of stream depletion by wells, by C. T. Jenkins: USGS—TWRI Book 4, Chapter D1. 1970. 17 pages.

Book 5. Laboratory Analysis

Section A. Water Analysis

- 5–A1.Methods for determination of inorganic substances in water and fluvial sediments, by M.J. Fishman and L. C. Friedman, editors: USGS—TWRI Book 5, Chapter A1. 1989. 545 pages.
- 5–A2.Determination of minor elements in water by emission spectroscopy, by P. R. Barnett and E.C. Mallory, Jr.: USGS—TWRI Book 5, Chapter A2. 1971. 31 pages.
- 5-A3.Methods for the determination of organic substances in water and fluvial sediments, edited by R.L. Wershaw, M.J. Fishman, R.R. Grabbe, and L.E. Lowe: USGS—TWRI Book 5, Chapter A3. 1987. 80 pages.
- 5-A4.Methods for collection and analysis of aquatic biological and microbiological samples, by L.J. Britton and P.E. Greeson, editors: USGS—TWRI Book 5, Chapter A4. 1989. 363 pages.
- 5-A5.Methods for determination of radioactive substances in water and fluvial sediments, by L.L. Thatcher, V.J. Janzer, and K.W. Edwards: USGS—TWRI Book 5, Chapter A5. 1977. 95 pages.
- 5-A6.Quality assurance practices for the chemical and biological analyses of water and fluvial sediments, by L.C. Friedman and D.E. Erdmann: USGS—TWRI Book 5, Chapter A6. 1982. 181 pages.

Section C. Sediment Analysis

5-C1.Laboratory theory and methods for sediment analysis, by H. P. Guy: USGS—TWRI Book 5, Chapter C1. 1969. 58 pages.

Book 6. Modeling Techniques

Section A. Ground Water

- 6-A1.A modular three-dimensional finite-difference ground-water flow model, by M. G. McDonald and A. W. Harbaugh: USGS—TWRI Book 6, Chapter A1. 1988. 586 pages.
- 6–A2. Documentation of a computer program to simulate aquifer-system compaction using the modular finite-difference ground-water flow model, by S. A. Leake and D. E. Prudic: USGS—TWRI Book 6, Chapter A2. 1991. 68 pages.
- 6–A3.A modular finite-element model (MODFE) for areal and axisymmetric ground-water-flow problems, Part 1: Model Description and User's Manual, by L. J. Torak: USGS—TWRI Book 6, Chapter A3. 1993. 136 pages.
- 6-A4.A modular finite-element model (MODFE) for areal and axisymmetric ground-water-flow problems, Part 2: Derivation of finite-element equations and comparisons with analytical solutions, by R. L. Cooley: USGS—TWRI Book 6, Chapter A4. 1992. 108 pages.
- 6–A5.A modular finite-element model (MODFE) for areal and axisymmetric ground-water-flow problems, Part 3: Design philosophy and programming details, by L. J. Torak: USGS—TWRI Book 6, Chapter A5, 1993. 243 pages.
- 6–A6.A coupled surface-water and ground-water flow model (MODBRANCH) for simulation of stream-aquifer interaction by E.D. Swain and Eliezer J. Wexler: USGS—TWRI Book 6, Chapter A6, 1996. 125 pages.

Book 7. Automated Data Processing and Computations Section C. Computer Programs

- 7–C1.Finite difference model for aquifer simulation in two dimensions with results of numerical experiments, by P.C. Trescott, G. F. Pinder, and S. P. Larson: USGS—TWRI Book 7, Chapter C1. 1976. 116 pages.
- 7-C2. Computer model of two-dimensional solute transport and dispersion in ground water, by L.F. Konikow and J.D. Bredehoeft: USGS—TWRI Book 7, Chapter C2. 1978. 90 pages.
- 7–C3.A model for simulation of flow in singular and interconnected channels, by R.W. Schaffranek, R. A. Baltzer, and D. E. Goldberg: USGS—TWRI Book 7, Chapter C3. 1981. 110 pages.

Book 8. Instrumentation

Section A. Instruments for Measurement of Water Level

- 8-A1.Methods of measuring water levels in deep wells, by M.S. Garber and F.C. Koopman: USGS—TWRI Book 8, Chapter A1. 1968. 23 pages.
- 8-A2.Installation and service manual for U.S. Geological Survey manometers, by J. D. Craig: USGS—TWRI Book 8, Chapter A2. 1983. 57 pages.

Section B. Instruments for Measurement of Discharge

8-B2. Calibration and maintenance of vertical-axis type current meters, by G. F. Smoot and C.E. Novak: USGS—TWRI Book 8, Chapter B2. 1968. 15 pages.

Book 9. Handbooks for Water-Resources Investigations

Section A. National Field Manual for the Collection of Water-Quality Data

- 9-A6. Field measurements, by F.D. Wilde and D.B. Radtke, editors: USGS—TWRI Book 9, Chapter A6. 1998 [variously paged].
- 9-A7. Biological indicators, by D.N. Myers and F.D. Wilde, editors: USGS—TWRI Book 9, Chapter A7. 1997 [variously paged].
- 9-A8. Bottom-material samples, by D.B. Radtke: USGS—TWRI Book 9, Chapter A8, 1998 [variously paged].
- 9-A9. Safety in field activities, by S.L. Lane and R.G. Fay: USGS—TWRI Book 9, Chapter A9. 1998 [variously paged].